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Bridging Academic Boundaries: A Design and UAT Study of the Automated Credit Transfer System (ACTS)

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Abstract

This paper presents the design and User Acceptance Testing (UAT) of a Natural Language Processing (NLP)-driven Automated Credit Transfer System (ACTS) developed to automate and digitalize the academic credit transfer process at Universiti Poly-Tech Malaysia (UPTM). The system matches courses using TF-IDF and cosine similarity algorithms to assess syllabus alignment and determine credit eligibility. The design phase was afforded the highest priority to develop usability, transparency and efficiency per institutional needs. 20 members of the Faculty of Computing & Multimedia (FCOM), who acted as Resource Persons (RP), attended the UAT to test the system's usability, correctness and functionality using real-time examples. A Technology Acceptance Model (TAM)-based questionnaire and semi-structured interviews were conducted for data gathering. Results are rated very high for end-user satisfaction and perceived usefulness, implying both support for the broader institutional feasibility of implementation and the priority it deserves. Results highlight the importance of including end-users in the design and evaluation phases and call for redesigning and improving adoption and performance.

Keywords: *User Acceptance Testing (UAT), Credit Transfer, Natural Language Processing (NLP), TF-IDF and Cosine Similarity, Technology Acceptance Model (TAM).*

Introduction

In the emerging tertiary education context, the function of effective, transparent and replicable administrative systems has never been as crucial as today. One such domain that needs revitalization is the academic credit transfer system, an essential enabler of student mobility, learning achievement and institutional cooperation (Yee & Hassan, 2024). Conventionally, credit transfer procedures at Universiti Poly-Tech Malaysia (UPTM), like at many other higher learning institutions, have been manual through heavy documentation, individual evaluation and lengthy processing. These inefficiencies are time-consuming for the academic community and create ambiguity and delays for students seeking inter-institutional mobility.

However, these challenges can be overcome by leveraging recent advancements in Artificial Intelligence (AI) and more specifically, in Natural Language Processing (NLP). NLP helps machines read, process and generate human language, providing a practical method for automating textual administrative work (Egger & Gokce, 2022). For credit transfer, for example, NLP may be applied to scan and match course syllabi, recognize semantic equivalencies and assist in objective decision-making. Taking advantage of this potential, an operational prototype system called an Automated Credit Transfer System (ACTS) was created using NLP methods, Term Frequency-Inverse Document Frequency (TF-IDF) and cosine similarity algorithms. The credit transfer process is proposed to be automated by automatically assessing course content equivalency between diploma and degree programs.

Its initial proof-of-concept implementation had already proven the technical viability of utilizing NLP to automate the evaluation of credit transfers. The system was configured to extract course descriptions from

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uploaded syllabi, normalize the text via tokenization, stop word filtering and lemmatization and then calculate similarity scores to assess credit eligibility. Although the prototype demonstrated encouraging characteristics of function and accuracy, the achievement will be based on the target users' acceptance of the system, including academic staff and critical stakeholders in credit evaluation processes (Triadi Wiranto & Arasy Alimudin, 2024).

User Acceptance Testing (UAT) is a crucial activity in software development, as it checks whether the system satisfies technical specifications, user requirements, procedures and usability standards (Hazdia et al., 2024). For ACTS, knowing how the academic staff think about the system's utility, ease of use and overall performance is essential if it is to be utilized on a large scale and integrated into institutional practices. For this, the current research endeavours to measure the acceptability of ACTS among users through an exhaustive UAT with 20 academic staff from the Faculty of Computing & Multimedia, Universiti Poly-Tech Malaysia.

This research uses the Technology Acceptance Model (TAM) assessment framework, which is popular and extensively used to explain how individuals adopt and use technology (Huang & Yang, 2025). TAM posits that perceived ease of use (PEOU) and perceived usefulness (PU) are the most effective antecedents of user adoption (Tan Christabel Michaela Devina & Hendro Lukman, 2024). Using the model, the research aims to ascertain how the factors influence behavioural intention to use ACTS and where interventions need to be added based on user comments.

Surveys and semi-structured TAM-based interviews were employed to gather UAT data. The users were required to utilize the system in real-world applications, including eligibility to transfer credits from real diplomas and degree courses. Their feedback provided usability, correctness and real-life use data, particularly in UPTM.

Literature Review

Credit Transfer Systems in Higher Education

Credit transfer processes are vital post-secondary learning processes that allow students to transfer academic credits earned in courses at one institution to another to promote academic mobility, lifelong learning and flexibility of study patterns (Cheung et al., 2021). It is especially helpful in enabling students to continue from one institution, program or nation to another.

Internationally, organizations like the European Credit Transfer and Accumulation System (ECTS) have been central to university credit standardization to ensure transparency and comparability of qualifications. In the United States and elsewhere, public higher education systems have established formal transfer streams, articulation contracts and credit guarantees to enhance student mobility and minimize credit loss when transferring (Richardson & Knight, 2024).

The manual credit transfer process in UPTM depends on administrative delay and discretion still exists. This issue has raised questions regarding fully automated credit transfer systems (ACTS) utilizing digital technology to automate the process. ACTS aim at eliminating inconsistency, enhancing transparency and simplifying administration. Through digitized syllabus matching and decision automation, ACTS could potentially facilitate the work of academic staff and make life easier for students.

However, there are challenges. Research points to the need for ease-of-use interfaces, safe data handling and institutional alignment to ensure practical application (Abhinava Barthakur et al., 2025). While automation is promising, the success of the credit transfer system rests finally on institutional policy, stakeholder acceptability and the system's flexibility to accommodate varying forms of academics (Barnes et al., 2021). Ongoing assessment through practices such as User Acceptance Testing (UAT) becomes essential to ensure that such systems meet the real-world needs of academic users and institutional objectives.

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Agile Software Development in Educational Systems

Agile development practices are employed globally in ed-tech initiatives since they allow iterative design, development and enhancement on an ongoing basis with user feedback (None Prisca Amajuoyi et al., 2024). The Agile methodology was used during the development of ACTS, allowing for the incorporation of design during real-time testing and iterative enhancements. The process enables the system to enhance alongside evolving user needs and institutional regulations.

System design in Agile is not a fixed, rigid step-by-step process but a repeating process during development cycles (sprints). It is particularly relevant in academia, where the academic framework and administration procedures might change repeatedly. Agile supports quick prototyping, where initial designs are developed, tested and modified depending on the reaction of real users (Obaid, 2024). This yields a more feasible and usable system design in tune with blue-ribbon academic processes.

Additionally, Agile promotes high levels of engagement between developers and end users like academic staff, programme coordinators and administrative staff (Al-Zewairi et al., 2017). Hence, the user interface and functionality of the system are institutional workflows and expectations-driven. Design decisions within this approach to collaboration are user-driven rather than assumption-driven.

User Acceptance Testing (UAT), another critical element of Agile, is closely tied to design validation. It enables intended users to use the system in real-world scenarios, generating valuable feedback on whether the design facilitates usability, functionality and institutional needs (Iqbal & Fahad Khan, 2014). Design inputs derived from UAT drive final design modifications before the release of the overall system. Overall, Agile methodology facilitates user-centred design in ACTS development so that the system is adaptive, functioning and aligned to changing needs in Malaysian higher education.

User Acceptance Testing (UAT) for ACTS

User Acceptance Testing (UAT) is an essential step of ACTS development to verify that the system operates and performs as desired in real academic environments. The UAT process began with identifying the scope of activities, such as uploading the syllabus, similarity score calculation, credit transfer checking, and report generation.

Test cases, a plan and task assignments were developed using a step-by-step UAT. An independent test environment mimicking the live setting was established and course syllabi were used to model actual credit transfer evaluation (Igor Buzhinsky & Valeriy Vyatkin, 2019). Testing was executed through exercises performed by academic staffs who acted as a Resource Person, such as uploading syllabi, checking similarity scores and checking credit transfer outputs.

Data were gathered through feedback to validate system usability, accuracy and conformity with the institution's specifications. Defects such as bugs, functionalities, or ineffectiveness in their operation witnessed during discovery were recorded and addressed by the development team. Users' training and user manual issuance were among the activities before UAT. The system was deployed to the live environment once stakeholders confirmed that ACTS met their specifications. This systematic approach to UAT makes ACTS robust and interactive, and institutionalizing this credit transfer process transparent and smooth in UPTM.

User Interface Design and Results

User Acceptance Testing (UAT) phase was a key element in functional and design testing of the Automated Credit Transfer System (ACTS). Performed at Universiti Poly-Tech Malaysia (UPTM), the phase involved 20 academic staff who needed to test ACTS using real academic credit transfer cases and furnish feedback for the final polishing.

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Interface Design of ACTS

User experience for ACTS revolved around usability, simplicity and compliance with scholarly workflows in daily life. Built-in Agile, the interface underwent multiple improvements based on continuous stakeholder input through sprint cycles. The intention was to allow stakeholders to use and work with the system efficiently despite their different comfort levels with technology.

Key components of the ACTS interface include a syllabus upload module, a similarity score viewer and a report generation tool.

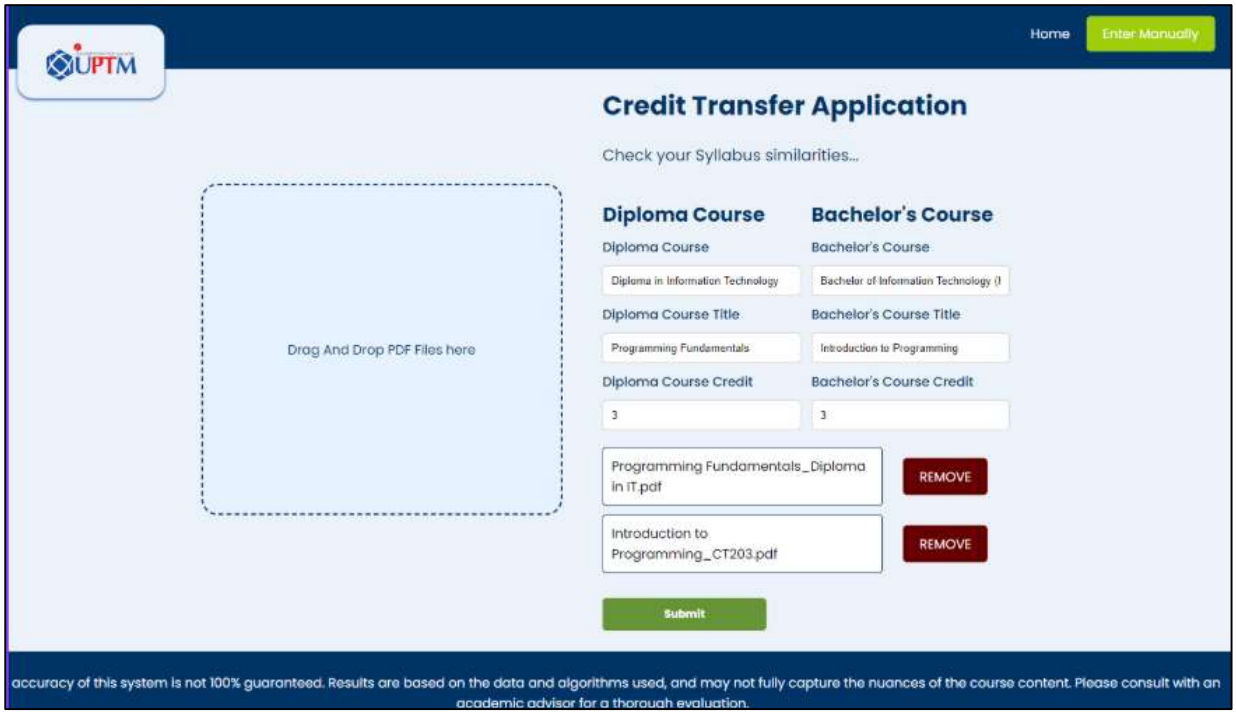

Figure 1. Syllabus Upload Module

In Figure 1, users can upload diploma and degree syllabi side-by-side, with guided input fields and format validation to minimize errors.

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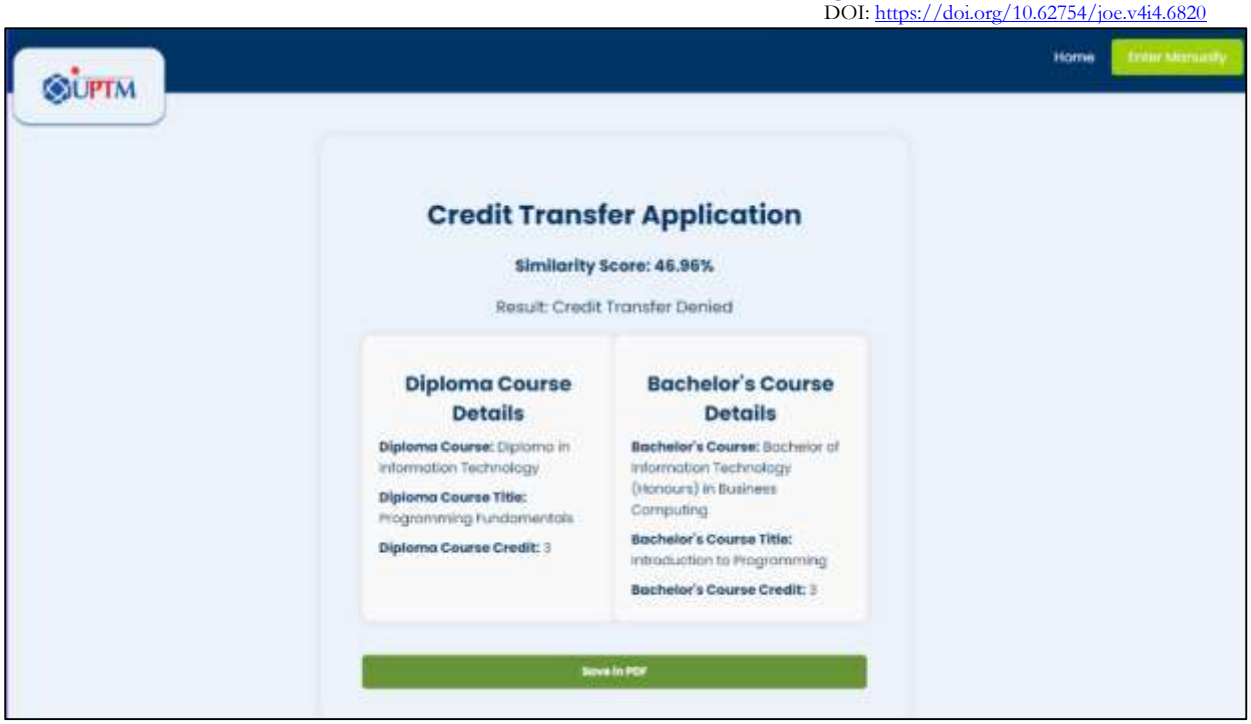

Figure 2. Similarity Score Viewer Module

Figure 2 shows a visual panel that displays the cosine similarity score between two-course syllabi. The similarity score presented as a percentage is calculated using Term Frequency–Inverse Document Frequency (TF-IDF) and cosine similarity algorithms applied to the textual content of both syllabi.

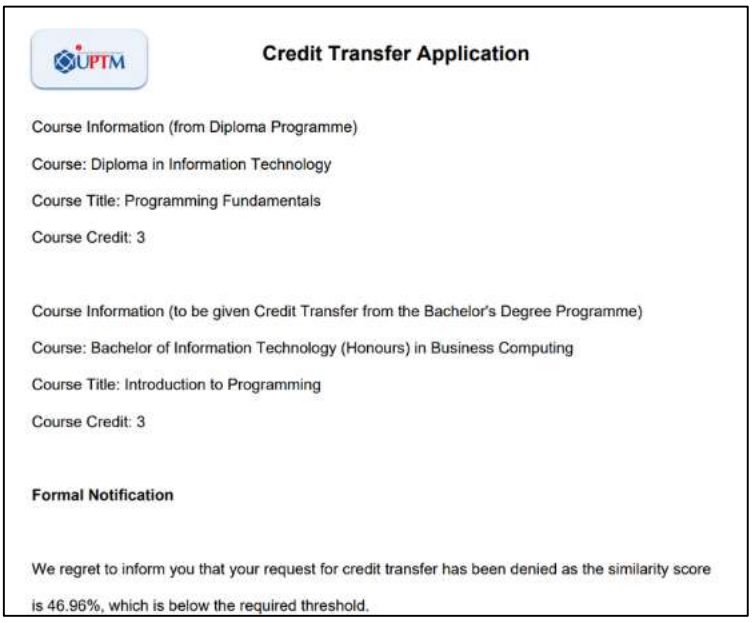

Figure 3. PDF Report Generator Module

Figure 3 shows the PDF report generated by ACTS, allowing users to download PDF credit transfer reports and summarizing course comparisons and eligibility outcomes.

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User Acceptance Testing (UAT) Approach

User Acceptance Testing (UAT) was not merely designed to confirm the correctness of the system's operation but to evaluate its acceptability and adoptability based on the Technology Acceptance Model (TAM). Two constructs, Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are stipulated by TAM as determinants of users' attitudes and intentions to adopt a system.

Participants were asked to apply the ACTS system based on actual instances of credit transfer for gathering informative feedback. Upon finishing the interaction, they filled out a TAM-based survey with Likert-scale items across four broad constructs: PU, PEOU, Attitude Toward Use (ATU), and Behavioral Intention to Use (BI).

TAM questionnaires used statements regarding topics like system performance, decision consistency, simplicity of the interface and intention to use the system in the future in testing exercises.

Table 1. TAM-Based UAT Results from Resource Persons (RPs)

No.	TAM Construct	Survey Statement	Mean	SD	Interpretation
1	Perceived Usefulness (PU)	ACTS improves the efficiency of credit transfer evaluation.	4.80	0.41	Very High
2	Perceived Usefulness (PU)	ACTS helps me make more consistent academic decisions.	4.75	0.44	Very High
3	Perceived Ease of Use (PEOU)	ACTS is easy to navigate and requires minimal effort to learn.	4.70	0.47	Very High
4	Perceived Ease of Use (PEOU)	I can complete tasks in ACTS without external assistance.	4.65	0.49	Very High
5	Attitude Toward Use (ATU)	I enjoy using ACTS for evaluating credit transfers.	4.60	0.50	High
6	Attitude Toward Use (ATU)	Using ACTS is a positive experience overall.	4.70	0.47	Very High
7	Behavioral Intention (BI)	I intend to use ACTS regularly in future credit transfer processes.	4.85	0.36	Very High
8	Behavioral Intention (BI)	I would recommend ACTS to my colleagues.	4.90	0.31	Very High

Table 1 depicts the answers of 20 Resource Persons (RPs) who took part in the UAT. All constructs had extremely high average ratings, and most recorded a "Very High" level of agreement, reflecting the high user satisfaction and intent to use ACTS as part of their academic work.

These findings support the belief that system adoption is as much a matter of perceived capability as technical ability. The combination of high ratings for ease of use and usefulness, along with positive feelings toward using the system, indicates that ACTS adequately addresses institutional and personal user requirements. In addition, the ease of use of the system interface was cited as a key factor behind its acceptability and ease of use.

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Discussion

As reflected in the TAM-based evaluation, as shown in Table 1, Resource Persons rated ACTS highly across all constructs, affirming its alignment with institutional needs and user expectations. The system's automatic credit transfer eligibility checking using the NLP techniques of TF-IDF and cosine similarity was highly acceptable to the Resource Persons (RPs) and academicians. Their satisfaction establishes the technical adequacy of ACTS and its readiness for integration into the real world of academia.

Technology and Usability Synergy

Among the interesting discussion points arising from the UAT is the balance between algorithmic precision and user interface usability. The automated similarity score engine functioned as intended in determining course alignment. However, its effect was only fully realized through the simplicity with which users could interact and decipher the results. It highlights the value of boiling sophisticated outputs into intuitive, though insightful, representations with side-by-side syllabus comparison and summary reports. This is supported by the high Perceived Usefulness score (Mean = 4.80), indicating users recognized the value of automated decision support.

User Interface as a Determinant of Adoption

Consistent with the Technology Acceptance Model (TAM), the perceived usefulness and ease of use directly influenced the participants' behavioural intention to adopt ACTS. Participants reported that the user interface reduced the cognitive burden typically associated with manual credit evaluation. By minimizing the number of clicks, offering straightforward navigation and integrating helpful visuals, the system enhanced user engagement and lowered the barrier to adoption. The strong Behavioral Intention to Use score (Mean = 4.90) suggests that the intuitive design of ACTS directly enhances adoption intent, consistent with TAM's theoretical pathway from perceived ease to behavioural intention. It affirms that user interface design is not a secondary concern but a primary factor in successfully implementing institutional technologies.

Importance of Stakeholder Engagement

The iterative Agile-based design of ACTS, which actively involved academic stakeholders from the start, also contributed significantly to its positive evaluation. RPs noted that the interface and processes reflected their actual workflow, indicating that developer-user collaboration during the sprint cycles had resulted in a more institutionally aligned product. It reinforces the necessity of engaging real users, not just as testers but as co-designers, during the system development lifecycle. The engagement of RPs in co-design aligns with the positive attitude scores (Mean = 4.60, 4.70), underscoring the impact of participatory development on acceptance.

Challenges and Opportunities for Improvement

Although the TAM results reflect intense user satisfaction, some participants provided constructive feedback on additional features that could enhance long-term usability and scalability. A few participants suggested more detailed explanations of similarity results, integration with institutional student records and enhanced support for multilingual syllabi. These suggestions present clear directions for future system iterations. Additionally, some noted the need for cross-institutional compatibility to support external transfer applications as a future scalability consideration.

A limitation of this study is its sample size and institutional scope, which may affect generalizability. Future studies may expand testing to a broader range of universities.

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Conclusion

The User Acceptance Testing (UAT) of the Automated Credit Transfer System (ACTS) confirms its effectiveness as a user-centered solution for automating credit transfer processes in higher education. Integrating Natural Language Processing (NLP) with an intuitive user interface has enabled accurate syllabus matching, ensuring ease of use, transparency and institutional alignment. The TAM-based assessment yielded uniformly high ratings on all the measures: Perceived Usefulness, Perceived Ease of Use, Attitude Toward Use and Behavioral Intention, indicating high levels of acceptance among academicians. These results validate that functionality and user interface design are critical to effective technology adoption. The research also validates the necessity of including end users throughout the system's development life cycle. Positive feedback from Resource Persons and faculty members demonstrates that ACTS meets technical and user requirements, supporting its broader adoption. The study also highlights the importance of involving end users in system design and validation, reinforcing that functionality and interface design must go hand in hand to achieve successful implementation and long-term sustainability.

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